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Determinants of Intelligent Energy Implementation Towards Firm Performance: A Conceptual Framework Moderated by Board Gender Diversity and Board Sustainability Committee

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Abstract

This study examines the impact of Intelligent Energy assessed by the eight criterias to be followed by Malaysian listed companies (PLCs), regulated by Bursa Malaysia and which are monitored for industry best practice by the Malaysian Corporate Governance Code 2017 (MCCG 2017)—30 percent Women Boards of Directors as well as by the existence of the Board Sustainability Committee's proposed industry best practice which have not been endorsed by the MCCG 2017 to date.

In order to explore the reporting of the eight criteria of intelligent energy amongst Malaysian oil and gas public listed companies, in terms of gender-based and sustainability-based, it follows the methodology of descriptive statistics, regression analysis and content analysis derived from previous studies and the analysis of annual reports and integrated reports. This research provides a thorough analysis of present study breakthroughs in the worldwide oil and gas industry's Integrated Operations. The 30 percent moderation factor of Woman Board members, as per the Malaysian Code of Corporate Governance 2017 (MCCG, 2017), would be assessed to see whether having an increased representation of women would encourage the

implementation of the eight criteria of Intelligent Energy, as well as the moderation factor of the Board Sustainability Committee, which has not yet been made recommended practice by MCCG 2017, would be a driving force towards intelligent energy within the Malaysian oil and gas industry. Other than the Malaysian oil and gas sector, the Intelligent Energy scoring index could be applied to other oil and gas PLCs in the ASEAN region, such as Vietnam and Myanmar, which have growing oil and gas resources.

Keywords: intelligent energy, integrated operations, board gender diversity, oil and gas industry, and board sustainability committee

1. Introduction

As the digital revolution swept through many industries, it has disrupted established business models and created new winners and losers as fast movers have leveraged the digital age to gain competitive advantage. Just as the Internet has transformed the information and media industries, smartphones have revolutionized communications and social media, and the Industrial Internet has turned assets like jet engines and locomotives into data churning "smart" machines that "talk" to each other and self-diagnose problems, resulting in the Digital Oilfield which is poised to transform the oil and gas industry.

The Digital Oilfield represents a business-wide reimagining of the oilfield. It requires business leaders to step back from the traditional view of technology advancement—siloed within individual departments—and adopt a cross-organization approach (Accenture, 2015).

"The true realization of the Digital Oilfield vision comes not in the field, but in head office, and how producers change their business processes to leverage analytics and to integrate the silos that can exist, for example, between the exploration and production sides of the business. Unlocking this potential is as much about people and process as it is about technology" (JuneWarren-Nickle Energy Group, 2016, 2017).

The Industrial Internet of Things (IIoT) represent the next stage of the Intelligent Oilfield which some call Digital Oilfield 2.0. The original Digital Oilfield, also known by other names including Smart Fields, Field of the Future and Integrated Operations, began around the year 2000 was IT-led and technology focused, and resulted in the expansion of automation, the use of digital devices, the addition of remote operation centers, standardization of selected workflows, and the practice of 'manage by exception' to operate fields. Most of Digital Oilfield activity was focused on offshore production, especially deep water, due to the value of the assets involved. But over time it has spread onshore, to drilling, completions and beyond. Its success onshore was initially limited to larger conventional fields, as the cost of automation for both smaller green fields and legacy brownfields was considered prohibitive (EUCI, 2020)

2. Problem Statement

A well-established work process usually is defined, documented and well understood and forms the traditional business process that are handed down from the founder through generations without being revised and are thought to be the most respected and perfect business processes which are usually deemed as legacies (Epsis, 2021)

However, for many workers these processes only make up a portion of their work day as they engage in numerous other activities which are less understood and can prove to be problematic through inefficiencies or inconsistent execution. Some processes are legacy work habits by former senior employees which are either undocumented and poorly understood and could be the wrong process which may result in the desired outcome. Undocumented work would be very difficult to be handed over to new employees to employees covering the work for other employees on vacation which will result in backlogs and consequently double

checking of work and manual validation that would take up extra and unnecessary time and efforts. Complexity grows massively if more than a single role is involved, as activities now need to be coordinated which requires effective collaboration (Epsis, 2021)

Since the turn of the millennium, most major oil companies and global operating vendor/service companies have increasingly addressed oil exploration and operation enabled by information and communication technology as their future way of doing business. Integrated Operations (IO) is a concept used to describe this new way of doing business (de Campos Lima, Aranha, de Castro, Lima, Hougaz & de Souza Terra, 2018; Rosendal & Hepso, 2013).

According to Larsen (2012), Integrated Operations (IO) is the integration of people, work processes and technology to make smarter decisions and better execution. It is enabled by using shared real time information, collaborative technologies and multiple expertise across disciplines, organizations and geographical locations. There is a multiplicity of names for Integrated Operations, coined by oil companies, some of which are: Digital Oil Field, Digital Oil Field of the Future, Smart Fields, Smart Wells, iField, iWells, eField, and Intelligent Field (de Campos Lima, Aranha, de Castro, Lima, Hougaz, & de Souza Terra, 2018; Cramer et al., 2012).

Recognizing that Integrated Operations is not something new but should have been gradually implemented by the global oil and gas companies, therefore this research aims to investigate the implementation process of Intelligent Energy which is also a form of Integrated Operations through the eight criterions in order to achieve firm performance for Malaysian oil and gas PLCs moderated by one third Women Leadership on Board and the Board Sustainability Committee.

3. Research Objectives

1) To investigate the amount of transparency of the 8 criterions of Intelligent Energy implementation and the related practices of the MCCG 2017—30% Women Board of Directors and Board Sustainability Committee across the Malaysian oil and gas PLCs.

2) To identify the impact of the disclosure extent of the 8 criterions of Intelligent Energy implementation in the trajectory of the profitability of Malaysian oil and gas PLCs.

3) To determine whether the moderating role of the MCCG 2017—30% Women Board of Directors positively affects the relationship between the 8 criterions of Intelligent Energy and the Malaysian oil and gas PLCs' financial performance.

4) To identify if the moderating role of the Board Sustainability Committee positively affects the relationship between the 8 criterions of Intelligent Energy and the financial performance of the Malaysian oil and gas PLCs.

4. Research Questions

1) What is the amount of transparency of the 8 criterions of Intelligent Energy and the related practices of the MCCG 2017—30% Women Board of Directors and Board Sustainability

Committee across the Malaysian oil and gas PLCs?

2) Does the disclosure extent of the 8 criterions of Intelligent Energy have impact on the profitability of Malaysian oil and gas PLCs?

3) Do the 30 percent Women Board of Directors of MCCG 2017 positively moderates the relationship between the components of the 8 criterions of Intelligent Energy and the profitability of the Malaysian oil and gas industry?

4) Do the members of the Board Sustainability Committee, positively moderates the relationship between the components of the 8 criterions of Intelligent Energy and the profitability of the Malaysian oil and gas industry?

5. Literature Review

Maintenance and improvement efforts are critical to achieving economic strength in the petroleum business. The overarching goal of maintenance is to "… increase the operation's profitability and optimize the whole lifespan sans sacrificing security or climate change" (Khan & Haddara, 2003, p. 561).

The ultimate goal of the adjustments is to boost the operation's profitability. Improvements often attempt to provide an installation with enhanced capacity, such as the ability to do tasks more quickly and/or with new features. Petroleum firms on the Norwegian Continental Shelf (NCS) are increasingly introducing the operating idea of Integrated Operation (IO).

IO is described as "… the movement of human, procedures, and technologies to create and implement smarter choices more quickly" (Lilleng & Sagatun, 2010). It entails bringing real-time data from offshore assets onshore, laying the foundation for the development of fully integrated working practices (Holst & Nystad, 2007).

IO may appear in a variety of ways depending on the installation. According to Edwards et al. (2010), they commonly recognize IO on an installation by introducing three variations:

1) A shift to a real-time or near-real-time mode of operation.

2) The collaboration of one or more remote sites or teams.

3) A shift toward a more multidisciplinary approach to work.

The emergence of IO means that old ways of working are being replaced by IO changes in processes (Ringstad & Andersen, 2007). IO usually implies that duties are being shifted from offshore to onshore. Offshore duties are frequently related with administrative and strategy. In many firms, implementing IO necessitates the formation of a judgment land organization that collaborates with an implementing offshore organization (Drivoldsmo et al., 2007).

IO also involves more work being outsourced to construction companies and other third parties, as well as greater integration of operator and contractor responsibilities (Skjerve & Rindahl, 2010). Because of technological advancements and growing maturity of IO organizations, the amount of work done onshore is projected to expand further in future generations of IO. This

will very certainly result in fewer offshore employment. Means of increasing onshore awareness of offshore circumstances and threats will thus be critical. (Lilleng & Sagatun, 2010) created a model with eight interconnected success criteria, often known as layers. These characteristics, taken together, are thought to be both essential and sufficient for value production under IO. It is critical for success to ensure that the criterias are integrated vertically as well as horizontally.

The criteria are as follows, from the bottom to the top of the pyramid:

According to Criterion 1, effective IO requires the ability to record data (e.g., process and condition data) offshore for real-time transmission to shore, as well as remotely control relevant technology (e.g., sensors). These data may generally include data on the state of the facility (e.g., integrity, condition of equipment) and the present environmental conditions in terms of safe and achievable maintenance planning from onshore (e.g., wind, wave height, temperature).

Criterion 2 states that data must be conveyed and used, which places demands on communication infrastructure, data transmission, and data communication standards.

Criterion 3 pertains to information access: data must be successfully converted into information. For maintenance planning, this also implies that data must be converted into information that is useful for workers who are not located offshore and have little facility expertise.

Criterion 4 is concerned with information visualization and workplaces. Since information in an IO scenario is frequently exchanged across disciplines and geographical regions, additional demands are placed on workplaces and surfaces. Furthermore, IO planning is a multidisciplinary effort that involves proactive and early information usage. Visual interface technologies must be user friendly and capable of presenting discipline specific information to multidisciplinary teams in ways that facilitate common understanding in order to operate successfully across disciplines and in mediated collaboration.

Criterion 5 is concerned with collaboration work domains, in which visual interface technologies contribute which includes both the appropriateness and flexibility of physical collaboration rooms or equipment to fulfil the collaboration demands at hand, as well as the scheduling of collaboration sessions in the work practices of the teams.

Criterion 6 is concerned with organizational, networking, and work process structure, whereas Criterion 7 is concerned with an organization’s mentality, leadership, and training.

Criterion 8 further includes the three main principles of the Malaysian Code of Corporate Governance of Principle A, Principle B and Principle C.

6. Theoretical Framework

6.1 Stakeholder Theory

The stakeholders of a firm are influencers of financial and non-financial reporting and have an impact on particular reporting disclosures. Increased stakeholder pressure and stakeholder opinion of the business were discovered to impact the non-financial information reported. A corporate report may be used to engage stakeholders as well as respond to concerns made by stakeholders. Many businesses released non-financial statistics that they claim to be of importance to their stakeholders (Clayton, Rogerson, & Rampedi, 2015).

6.2 Agency Theory

As per Jensen and Meckling (1976), an agency contract is developed when agents, who are managers appointed by the principal, who is the company's owner, are given the right to make decisions on the principal's behalf. The most common cause of an agency problem is knowledge imbalance between shareholders and directors. The problem of asymmetric information may be reduced by disclosing non-financial information, which provides a coordination and collaboration between directors and minority interests (Luk & Yap, 2017; Frias-Aceituno et al., 2012).

7. Proposed Conceptual Framework

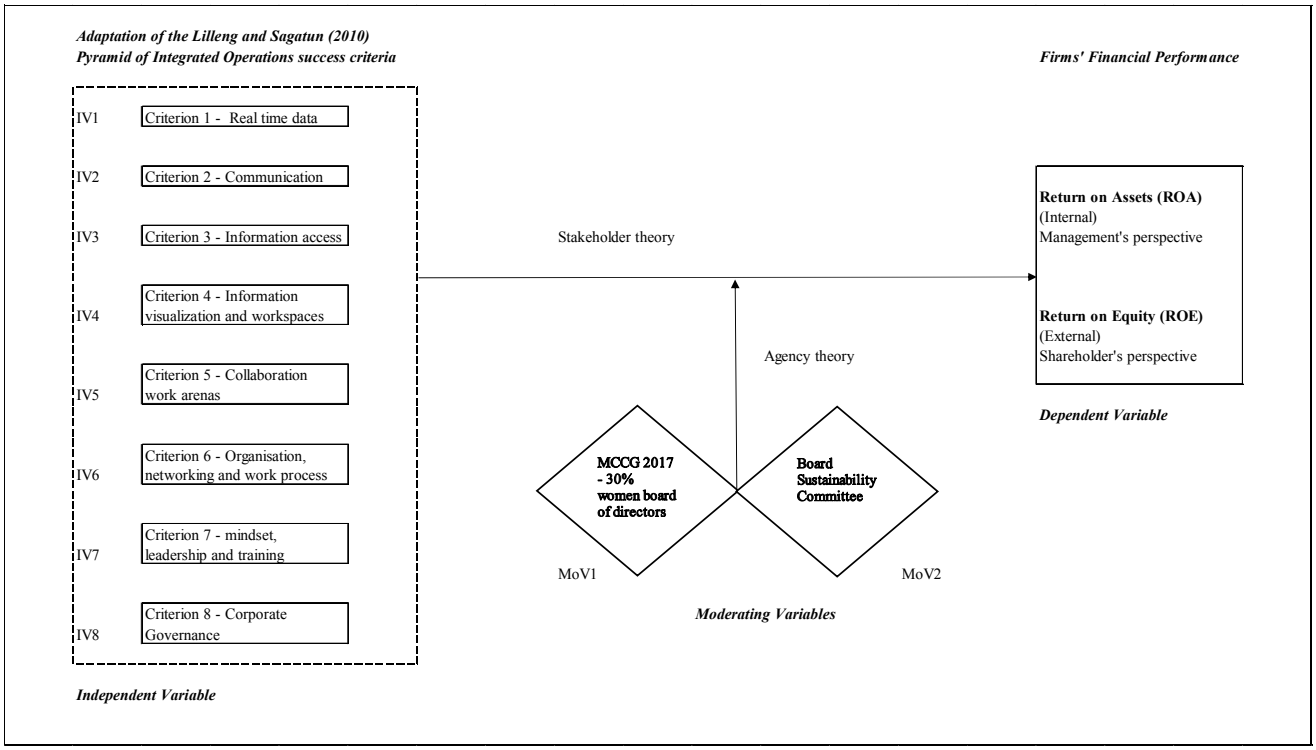

Figure 1. Proposed conceptual framework

Moderating Variable 1—MCCG 2017: 30% Women Board of Directors

MCCG 2017, under Principle A: Board Leadership and Effectiveness, Practice note 4.5 states that 'The board discloses in its annual report the company's policies on gender diversity, its targets and measures to meet those targets. For Large Companies, the board must have at least 30% women directors' (Securities Commission Malaysia, 2017).

Moderating Variable 2—Board Sustainability Committee

The World Economic Forum's Global Risks Report, which was released in January 2018, reported that environmental concerns have topped the global risk list again. All five risks in the environmental category are ranked higher than average in terms of both likelihood and impact over a 10-year horizon. A survey conducted by Deloitte and Forbes in 2017 indicated that sustainability has emerged as the top risk for senior leaders. The stakes are high, and directors need to act now to recognize sustainability as a fundamental element of their stewardship and fiduciary role. (Deloitte, 2018).

Dependent Variable—Firm Performance (Return on Equity and Return on Assets)

Return on equity (ROE) is considered as a measure of how a company creates for its owners. ROE equals net profit divided by the book value of shareholder investment. The value of reserves, which might be paid out to shareholders, is typically included in shareholder equity (Richard, Devinney, Yip, & Johnson, 2009).

Numerous metrics, such as return on asset (ROA) (Khanna & Palepu, 2000), return on equity (ROE), Tobin's Q (Habib & Ljungqvist, 2005; Khanna & Palepu, 2000), market to book value ratio (MBVR) (Sarkar & Sarkar, 2000), return on employed capital, operating profit margin, and so on, have already been used to assess the profitability of a firm.

Measures like as ROA and ROE are accounting-based measurements of productivity, whereas Tobin's Q and MBVR are stock-market-based measurements. Accounting-based measurements represent past financial success, whereas market-based measurements represent future financial success. If ROA were chosen as a measure of corporate performance, it would simply indicate how efficiently the business used its assets to create profit.

That, though, is not the main predictor of a company's success. Aside from utilizing assets, the corporation must also prudently invest in equity in order to create larger earnings that would satisfy the business's investors. This can encourage the adoption of return on equity (ROE) as a metric for measuring corporate success. The usage of ROE, on the other hand, can be troublesome. If investors are not cautious, it has the potential to deflect attention away from corporate fundamentals and lead to negative shocks. Companies might use financial tactics to artificially maintain a good ROE for a short period of time while concealing worsening performance in company fundamentals.

Mounting debt burden and stock buybacks supported by accumulated cash can enable a corporation to retain its ROE even while operational profitability is declining. Both ROA and

ROE are determined using a company's balance sheet and other financial data, and hence do not account for market-oriented factors. Furthermore, owing to investor expectations, balance sheet releases may have an impact on stock market gauges (Chaudhuri, Kumbhakar, & Sundaram, 2016).

8. Hypotheses of the Study

Hypothesis 1: *The Intelligent Energy Indicators have a favorable influence on business financial performance.*

Hypothesis 2: *MCCG 2017—30 percent presence of women on corporate boards helps to magnify the link between Intelligent Energy determinants and business financial success.*

Hypothesis 3: *Board Sustainability Committee positively moderates the relationship between the Intelligent Energy determinants and firm financial performance.*

9. Proposed Models for Future Empirical Testing

Against this background, and in line with the objectives of this study the following models are proposed for future empirical testing:

Model 1:

$$ROE = \beta 0 + \beta 1CRT1 + \beta 2CRT2 + \beta 3CRT3 + \beta 4CRT4 + \beta 5CRT5 + \beta 6CRT6 + \beta 7CRT7 + \beta 8CRT8 + \varepsilon it$$

Whereas

ROE = Return on Equity, which is used to assess the accounting efficiency of listed oil and gas firms in Malaysia

ROA = Return on Assets, which is used to assess the accounting performance of listed oil and gas firms in Malaysia

CRT1 = Criterion 1

CRT 2 = Criterion 2

CRT 3 = Criterion 3

CRT 4 = Criterion 4

CRT 5 = Criterion 5

CRT 6 = Criterion 6

CRT 7 = Criterion 7

CRT 8 = Criterion 8

MCCG2017WBOD = MCCG 2017 – 30% Women Board of Directors

BSUSTCOM = Board Sustainability Committee

ε it = Error term

Model 2:

$$ROA = \beta 0 + \beta 1CRT1 + \beta 2CRT2 + \beta 3CRT3 + \beta 4CRT4 + \beta 5CRT5 + \beta 6CRT6 + \beta 7CRT7 + \beta 8CRT8 + \varepsilon it$$

Model 3:

$$ROE = \beta 0 + \beta 1CRT1 + \beta 2CRT2 + \beta 3CRT3 + \beta 4CRT4 + \beta 5CRT5 + \beta 6CRT6 + \beta 7CRT7 + \beta 8CRT8 + (\beta 8\ CRT1 * MCCG2017WBOD) + (\beta 9CRT2 * MCCG2017WBOD) + (\beta 10CRT3 * MCCG2017WBOD) + (\beta 11CRT4 * MCCG2017WBOD) + (\beta 12CRT5 * MCCG2017WBOD) + (\beta 13CRT6 * MCCG2017WBOD) + (\beta 14CRT7 * MCCG2017WBOD) + (\beta 15CRT8 * MCCG2017WBOD) + \varepsilon it$$

Model 4:

$$ROA = \beta 0 + \beta 1CRT1 + \beta 2CRT2 + \beta 3CRT3 + \beta 4CRT4 + \beta 5CRT5 + \beta 6CRT6 + \beta 7CRT7 + (\beta 8\ CRT1 * BSUSTCOM) + (\beta 9CRT2 * BSUSTCOM) + (\beta 10CRT3 * BSUSTCOM) + (\beta 11CRT4 * BSUSTCOM) + (\beta 12CRT5 * BSUSTCOM) + (\beta 13CRT6 * BSUSTCOM) + (\beta 14CRT7 * BSUSTCOM) + (\beta 15CRT8 * BSUSTCOM) + \varepsilon it$$

10. Scope and Methodology of the Study and Operationalization of Variables

The study's sample will look at public listed firms that produce Annual Reports or Integrated Reports from a population of 888 Malaysian PLCs listed on Bursa Malaysia.

The data will be collected between 2016 and 2018. This study offers a sample of 34 oil and gas public listed companies (PLCs) on the Malaysian stock exchange (Bursa Malaysia). To analyze yearly reports or integrated reports, this study presents a descriptive statistics and regression analysis approach, as well as quantitative content analysis. The MCCG 2017 Practice Note 4.5 – Board Gender Diversity will be used to assess board gender diversity. The board of directors of large corporations must have at least 30% female directors.

Gender equality will be measured using a dichotomous approach in which a disclosure is assigned a value of 1 if it is revealed in the company's report and a value of 0 if it is not. Because the data is only collected from 2016 to 2018, the 30% women directors would only be able to be presented in the 2018 annual reports following the MCCG 2017 announcement in 2017 with implementation beginning in 2018.

The Board Sustainability Committee is a new agenda within the Malaysian corporate governance landscape which have not been published yet within the Malaysian Code of Corporate Governance 2017.

The most prominent and commonly utilized approach in research and accounting disclosures is content analysis (Zahid and Ghazali, 2015; Boesso and Kumar, 2007). Both qualitative and quantitative metrics can be used in content analysis. The quantitative content analysis is thought to be more dependable (Zahid & Ghazali, 2015; Day & Woodward, 2009). The quantitative content analysis approach will be used in the current investigation.

The content analysis approach of data coding would be based on themes, words, or things discovered in the data (Nilsson, 2016; Collins & Hussey, 2014).

A score system will be utilized during the categorization to establish the extent to which the items were reported. The scoring method was developed after a study of prior research in which the proper amount of points was determined using content analysis. Larsson and Ringholm (2014), Eccles and Serafeim (2014), and Wang, Song, and Yao (2013) all employed four-point systems, whilst Wang, Song, and Yao (2013) utilized a three-point system. Setia et al. (2015) and Boiral (2013) both employed two-point systems. This study will employ a methodology similar to Nilsson's (2016) prior research on Integrated Reporting to allow for some differences between the organizations while remaining a time-effective way. Table 1 shows the system and the criteria that were employed.

Table 1. A new intelligent energy 8-criterion scoring index

A New Intelligent Energy 8-criterion Scoring Index for implementation
Criterion 1 (6 items)
• Ability to capture data offshore
• Remotely control relevant technology
• Safe and attainable maintenance
• Real time data
• Capture process data
• Capture condition data
Criterion 2 (4 items)
• Data communicated
• Data usable
• Communication infrastructure
• Data transmission
Criterion3 (3 items)
• Data to be converted to information
• Offshore data usable for onshore staff
• Data conversion success
Criterion 4 (6 items)
• Cross disciplinary activity
• Information visualization
• Workspaces
• Cross geographical locations
• Mediated collaboration
• Visual interface technologies
Criterion 5 (4 items)
• Physical collaboration rooms
• Physical collaboration equipment
• Scheduling of collaboration sessions

- Suitability and adaptability of collaboration

Criterion 6 (3 items)

- Organisation framework
- Networking framework
- Work process framework

Criterion 7 (3 items)

- Mindset
- Leadership
- Training

Criterion 8 (3 items)

- MCCG Principle A
- MCCG Principle B
- MCCG Principle C

11. Significance of Study

The recommended research is crucial for publicly traded companies because it enables annual report and integrated report preparers to recognize the value of planning and aggregating meaningful data for stakeholders as well as internal planning use in order to maintain legitimacy in the eyes of stakeholders and the general public. The publishing of the new Intelligent Energy 8-Criterion Scoring Index will be significant for both scholars and practitioners.

12. Conclusions and Recommendations

Integrated operations are still in their youth in Malaysia, and Malaysian oil and gas PLCs must enhance their disclosure standards towards the eight criteria that can be found within the Annual Report or the Integrated Report.

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